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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/648,245	08/27/2003	Chandra Mouli	M4065.0658/P658	3753
24998	7590	09/07/2005	EXAMINER	
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP			BLUM, DAVID S	
2101 L Street, NW			ART UNIT	
Washington, DC 20037			PAPER NUMBER	

2813

DATE MAILED: 09/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/648,245

Applicant(s)

MOULI ET AL.

Examiner

David S. Blum

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 June 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-131 is/are pending in the application.
- 4a) Of the above claim(s) 1-48 and 78-131 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 49-77 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 1-131 are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

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This action is in response to the election filed 6/23/05.

### **DETAILED ACTION**

#### ***Election/Restrictions***

1. Applicant's election without traverse of claims 49-77 in the reply filed on 6/23/05 is acknowledged.
2. Claims 1-48 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 3/14/05.
3. Claims 78-131 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species. Any consideration to rejoinder of these claims (or a portion of) will be determined when the current generic claim is in condition for allowance. Election was made **without** traverse in the reply filed on 6/23/05.

#### ***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 49-51, 54-56, 59-62, 65, 72-74, and 76-77 are rejected under 35 U.S.C. 102(b) as being anticipated by Matsumoto (EU 0 360 595).

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Matsumoto teaches all of the positive steps of claims 49-51, 54-56, 59-62, 72-74, and 76-77 as follows.

Regarding claim 49, Matsumoto forms a gate (8 is gate electrode) over a substrate, a first doped layer (11) of a first conductivity type in the substrate and adjacent said gate to a thickness of 100-500 angstroms (column 3 lines 43-44, 0.5 microns=500 angstroms), and a second doped region (5) of a second conductivity below the first region.

Regarding claim 50, the dopant concentration is between  $5 \times 10^{17}$  and  $1 \times 10^{19}$  atoms per  $\text{cm}^3$  (column 3 line 45).

Regarding claim 51, the dopant concentration is between  $1 \times 10^{18}$  and  $5 \times 10^{18}$  atoms per  $\text{cm}^3$  (column 3 line 45).

Regarding claim 49, when forming the first doped layer, an in-situ doped layer of said first conductivity is formed over a first area of the substrate ((column 6 lines 1-17, boron also dopes oxide layer 7 and electrode 8).

Regarding claim 55, the layer is annealed, thus ions are diffused (column 6 lines 11-15).

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Regarding claim 56, the diffusing (annealing) takes place between 900-1100 degrees C. (column 6 line 13).

Regarding claim 59, an undoped oxide layer (7) is formed over a second area of the substrate.

Regarding claim 60, ions of the first conductivity are implanted into the undoped oxide layer to form a doped oxide layer (column 6 lines 5-10).

Regarding claim 61, the doped oxide layer is annealed, therefore some ions will diffuse into the first region to form the first doped layer (column 6 line 13).

Regarding claim 62, the doped oxide layer is annealed between 900-1100 degrees C. (column 6 line 13).

Regarding claim 65, Matsumoto teaches forming the first doped region in a (gas) source plasma (column 4 lines 5-6, damage from the plasma processing) and in a third area of said substrate (electrode, SiO<sub>2</sub> and part 11).

Regarding claim 72, Matsumoto teaches nominally a concentration of  $10^{17}$  (column 5 line 4).

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Regarding claim 73, the first conductivity is a p-type (column 4 line 34) and the second conductivity is an n-type (column 4 line 35).

Regarding claim 74, the photodiode is a pnp photodiode (column 1 lines 15-45).

Regarding claim 76, the pixel sensor is part of a CMOS imager (written description describes a CMOS, thus a CMOS imager).

Regarding claim 77, the pixel sensor is part of a CCD imager (column 1 lines 5-7).

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595).

Matsumoto teaches all of the positive steps of claims 52-53 as recited above in regard to claim 49, except for the thicknesses and dosages.

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Regarding claim 52, Matsumoto does not teach a thickness of **about** 100-300 angstroms but teaches nominally 500 angstroms (.05microns) as taught in the instant specification (see claim 49 above). The instant specification does not teach any criticality between the taught range and the present claimed range. Therefore, this is considered a matter of optimization.

Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or of any unexpected results arising there from. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

These ranges are considered to involve routine optimization while it has been held to be within the level of ordinary skill in the art. As noted in In re Aller (105 USPQ233), the selection of reaction parameters such as temperature and concentration would have been obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art. Such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ233, 255 (CCPA 1955). See also In re Waite 77 USPQ 586 (CCPA 1948); In re Scherl 70 USPQ 204 (CCPA 1946); In re Irmischer 66 USPQ 314 (CCPA 1945); In re Norman 66 USPQ 308 (CCPA

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1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).

One skilled in the requisite art at the time of the invention would have used any ranges or exact figures suitable to the method in the process of forming a photodiode regarding temperature, thicknesses, and concentrations using prior knowledge, experimentation, and observation with the apparatus used in order to optimize the process and produce the photodiode structure desired to the parameters desired.

Regarding claim 53, Matsumoto does not teach a thickness of **about** 250 angstroms but teaches nominally 500 angstroms (.05microns) as taught in the instant specification (see claim 49 above). The instant specification does not teach any criticality between the taught range and the present claimed range. Therefore, this is considered a matter of optimization as recited above.

8. Claims 57-58 and 63-64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Kirkpatrick (US 4151008).

Matsumoto teaches all of the positive steps of claims 57-58 and 63-64 as recited above in regard to claim 56, except for the short durations of annealing.



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Regarding claim 57, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding claim 57, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding the claimed temperature, Matsumoto teaches 900 degrees C. as also taught by the instant specification. The instant specification does not teach any criticality (see case law regarding criticality above) between the taught range and the present claimed range. Therefore, this is considered a matter of optimization.

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Regarding claim 63, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding claim 64, Matsumoto teaches annealing at 900 degrees C. for about 1 hour (column 6 line 13). Kirkpatrick teaches a rapid thermal anneal which would cut anneal times from a few minutes –several hours to just seconds. The rapid thermal anneal may be used for repairing damage from implants and diffusing implants (column 6 lines 13-18). The advantage of the rapid thermal anneal is a reduction of device degradation (column 1 lines 41-46) and producing high temperatures in a limited area for a short period of time (column 5 lines 40-41). The exact duration of exposure is then a matter of optimization as recited above.

Regarding the claimed temperature, Matsumoto teaches 900 degrees C. as also taught by the instant specification. The instant specification does not teach any criticality (see case law regarding criticality above) between the taught range and the present claimed range. Therefore, this is considered a matter of optimization.

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It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by substituting a rapid thermal anneal as taught by Kirkpatrick to reduce device degradation (column 1 lines 41-46) and produce high temperatures in a limited area for a short period of time (column 5 lines 40-41).

9. Claims 66-67 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Todd (US006743738B2).

Matsumoto teaches all of the positive steps of claims 66-67 and 71 as recited above in regard to claim 65, except for particulars of forming the doped layer using B<sub>2</sub>H<sub>6</sub> and helium.

Regarding claim 66, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B<sub>2</sub>H<sub>6</sub> (column 1 line 61) and diluted by another gas (column 7 lines 35-36 and 48-49) in a plasma.

Regarding claim 67, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B<sub>2</sub>H<sub>6</sub> (column 1 line 61) and diluted by another gas, the another gas being helium (column 7 lines 35-36 and 48-49) in a plasma.

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Regarding claim 71, Todd teaches a gas plasma source conducted in a radio frequency (column 11 line 53) for about 2 minutes (claims 40, 34, and 24, about 2 minutes reads on about 1 minute, neither range having definite metes and bounds. This is considered optimization as recited above.).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by using a known boron ion dopant source and method rather than to expend research time and money to discover a novel source, when a known source is available.

10. Claim 70 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Todd (US006743738B2) and in further view of Fuse (US4861729).

Matsumoto and Todd teach all of the positive steps of claim 70 as recited above in regard to claim 65 except for doping in an electro cyclotron (ECR).

Todd teaches a gas plasma source conducted in a radio frequency (column 11 line 53) for about 2 minutes (claims 40, 34, and 24, about 2 minutes reads on about 1 minute, neither range having definite metes and bounds. This is considered optimization as recited above.). Matsumoto teaches forming the dopant-excited species in an electromagnetic energy and as an example radio

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frequency. Fuse teaches forming a plasma from decaborane using a radio frequency and an electronic field in electron resonance (ECR). Thus Matsumoto may be describing or suggesting ECR without naming it.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by using a known method such as ECR, rather than to expend research time and money to discover a novel method, when a known method is available.

11. Claims 68-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsumoto (EP 0 360 595) in view of Todd (US006743738B2) and in further view of Tom (US005993766A).

Matsumoto and Todd teach all of the positive steps of claims 68-69 as recited above in regard to claim 65, except for particulars of forming the doped layer using B<sub>2</sub>H<sub>6</sub> and helium.

Regarding claim 68, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B<sub>2</sub>H<sub>6</sub> (column 1 line 61) and diluted by another gas (column 7 lines 35-36 and 48-49) in a plasma. Tom teaches implanting boron from a source gas of B<sub>2</sub>H<sub>6</sub> (abstract), pentaborane, BF<sub>3</sub>, B<sub>2</sub>F<sub>4</sub> (equivalent to BF<sub>2</sub>) (column 9 lines 31, 36, 57, column 10 lines 54, 5766-67, column 11 line 1) as sources of boron ions, thus teaching

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an art recognized equivalence. It is noted that the instant specification does not teach any criticality between boron sources.

Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or of any unexpected results arising there from. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in the claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1515, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding claim 69, Matsumoto is silent as to the source of B ions (column 5 lines 61-62). Todd teaches implanting boron from a source gas of B<sub>2</sub>H<sub>6</sub> (column 1 line 61) and diluted by another gas, the another gas being helium (column 7 lines 35-36 and 48-49) in a plasma. Tom teaches implanting boron from a source gas of B<sub>2</sub>H<sub>6</sub> (abstract), pentaborane, BF<sub>3</sub>, B<sub>2</sub>F<sub>4</sub> (equivalent to BF<sub>2</sub>) (column 9 lines 31, 36, 57, column 10 lines 54, 5766-67, column 11 line 1) as sources of boron ions, thus teaching an art recognized equivalence. It is noted that the instant specification does not teach any criticality between boron sources.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Matsumoto by using a known boron ion dopant source and method rather than to expend research time and money to discover a novel source, when a known source is available and as taught by Tom to have an art recognized equivalence to other sources.

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12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (571)-272-1687) and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'D. S. Blum', with a long horizontal stroke extending to the right.

David S. Blum

September 6, 2005